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(54) Titre : COMBUSTIBLE LIQUIDE A FAIBLE POLLUTION ET METHODE DE FABRICATION DE CE COMBUSTIBLE
(54) Title: LOW POLLUTION LIQUID FUEL AND MANUFACTURING METHOD OF THE SAME

(57) Abrégé/Abstract:
According to a low pollution liquid fuel and a method of manufacturing the same of the present invention, the independent use of the liquid fuel or the mixed use thereof with gasoline enables an effect and an output similar to or greater than those of gasoline to be obtained without the need of modifying the structure or the material of existing internal combustion gasoline engines. Further, the contents of the carbon monoxide (CO) and hydrocarbons(HC) contained in exhaust gases can be remarkably reduced as compared with those emitted when the gasoline is used.

Figure 1

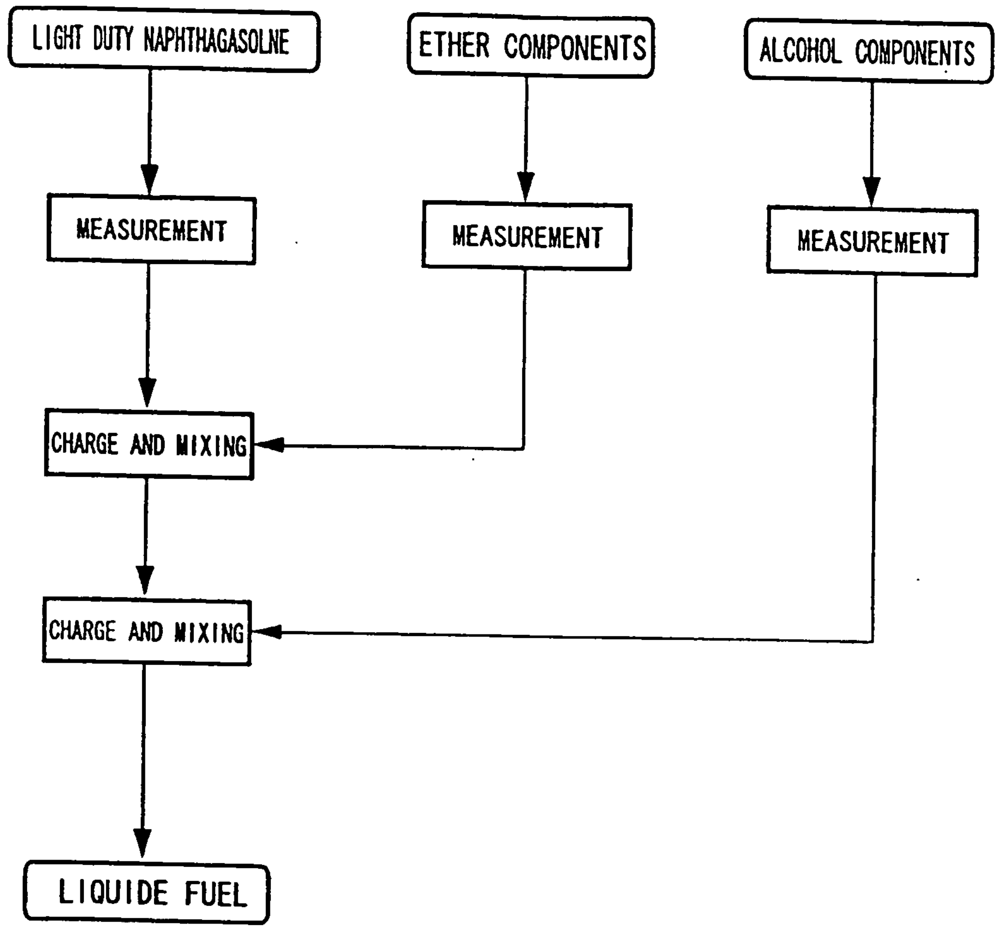
LIGHT DUTY NAPHTHAGASOLNE
ETHER COMPONENTS
ALCOHOL COMPONENTS
MEASUREMENT
MEASUREMENT
MEASUREMENT
CHARGE AND MIXING
CHARGE AND MIXING
LIQUIDE FUEL

Figure 2

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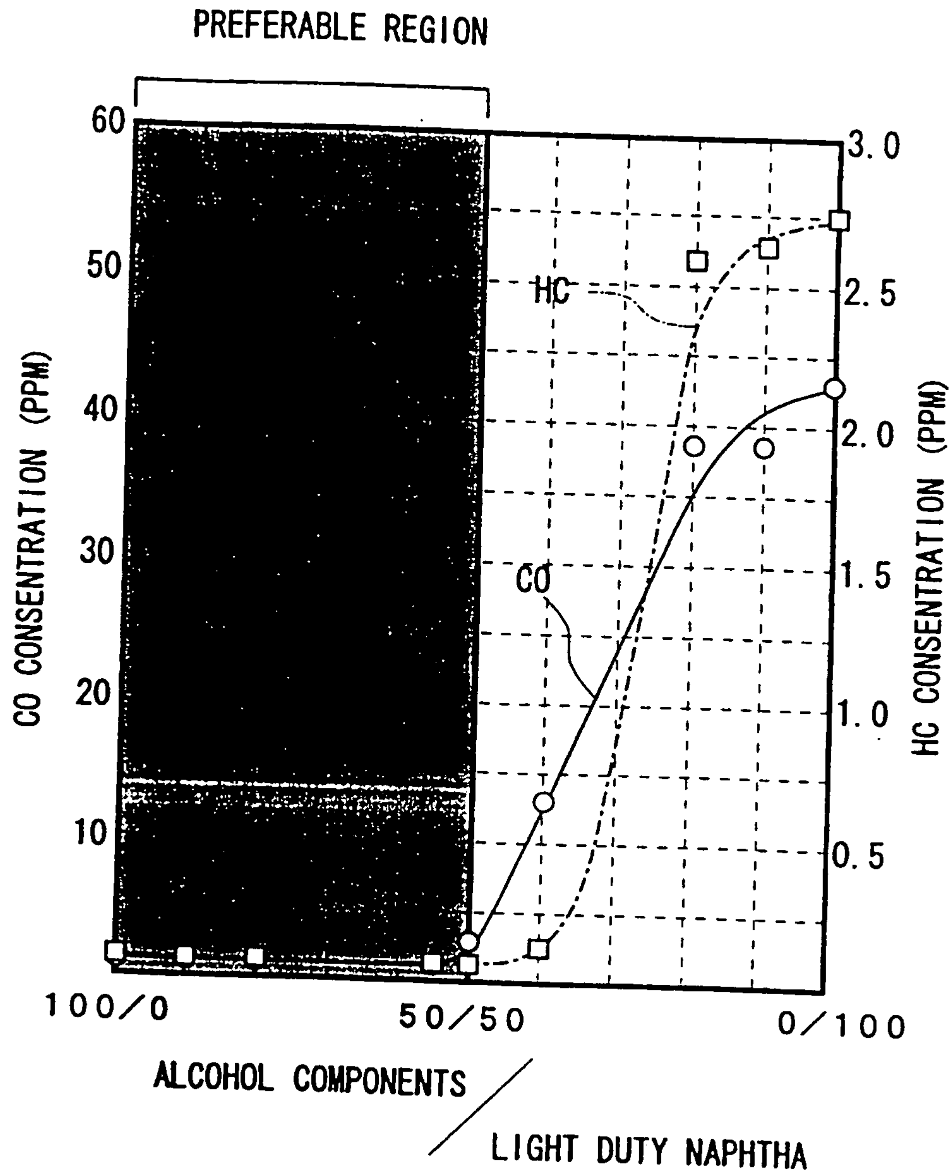

Ratio(alcohol/naphtha)	100/0	90/10	80/20	55/45	50/50	40/60	20/80	10/90	0/100
HC consentration(PPM)	0.07	0.08	0.08	0.08	0.08	0.15	2.60	2.66	2.75
CO consentration(PPM)	1.10	1.10	1.13	1.13	2.76	13.0	38.2	38.3	43.3

Table 1

Result of corrosion test of metal

Chemicals Inspection & testing Institute, Japan

Metal piece	Blend example 1 (not containing methanol)	
	Rate of change of mass(%)	Outside appearance
Copper	±0	Corrosion not admitted
Solder	±0.02	Corrosion not admitted
Brass	±0	Corrosion not admitted
Steel	±0	Corrosion not admitted
Cast iron	±0.02	Corrosion not admitted
Aluminum cast	±0	Corrosion not admitted
Metal piece	Comparative example (containing methanol)	
	Rate of change of mass(%)	Outside appearance
Copper	±0	Corrosion not admitted
Solder	±0.02	Corrosion not admitted
Brass	±0.01	Corrosion not admitted
Steel	±0.02	Corrosion not admitted
Cast iron	±0.02	Corrosion not admitted
Aluminum cast	±0	Corrosion not admitted
Metal piece	Regular gasoline	
	Rate of change of mass(%)	Outside appearance
Copper	±0	Corrosion not admitted
Solder	±0.02	Corrosion not admitted
Brass	±0	Corrosion not admitted
Steel	±0	Corrosion not admitted
Cast iron	±0.02	Corrosion not admitted
Aluminum cast	±0.01	Corrosion not admitted

Table 2

Result of corrosion test of rubber

(Chemicals Inspection & testing Institute, Japan)

Rubber used	Two kinds of NBR	Flourine Viton G-902
Hardness test		
Durometer hardness	A68	A73
Tensile strength test		
Tensile strength (Mpa)	21.2	24.6
Elongation(%)	560	340
Dipping test (24 hours)	Blend example 1 (not containing methanol)	
Change of hardness	-6	-1
Rate of change of tensile strength (%)	-21	-9
Rate of change of elongation (%)	-20	-12
Rate of change of volume (%)	+7	+1
Dipping test (24 hours)	Comparative example (containing methanol)	
Change of hardness	-15	-18
Rate of change of tensile strength (%)	-38	-29
Rate of change of elongation (%)	-22	-42
Rate of change of volume (%)	+56	+43
Dipping test (24 hours)	Regular gasoline	
Change of hardness	-11	-1
Rate of change of tensile strength (%)	-25	-6
Rate of change of elongation (%)	-18	-6
Rate of change of volume (%)	+11	±0

Table 3

Comparison of amounts of generated exhaust gases

	CO value	HC value	NOx value
Blend example 1	1.13 ppm	0.08 ppm	1800-2,000 ppm
Comparative example	7.45 ppm	0.23 ppm	1900-2,100 ppm
Gasoline	43.25 ppm	2.75 ppm	2000-2,200 ppm

DESCRIPTION

LOW POLLUTION LIQUID FUEL AND MANUFACTURING METHOD OF THE SAME

TECHNICAL FIELD

The present invention relates to an improved low pollution liquid fuel capable of obtaining an efficiency and an output similar to or higher than those of conventional gasoline without the need of changing the structure or the material of existing internal combustion gasoline engines and remarkably reducing the concentrations of carbon monoxide (CO) and hydrocarbon in exhaust gases as compared with those of conventional gasoline and to a method of manufacturing the liquid fuel.

BACKGROUND ART

As a recent countermeasure to the environment problems, more serious attention has been paid to the problem of the environmental pollution caused by the exhaust gases from automobiles. There have been available, as a low pollution liquid fuel, fuels containing naphtha mixed with methanol and other alcohols such as "GAIAX (trade name)", which has been available from the applicant. The fuel can greatly reduce the concentrations of carbon monoxide (CO) and

hydrocarbons in the exhaust gases from the automobiles and can be used in place of conventional gasoline.

The fuels which contain naphtha mixed with methanol and other alcohol such as "GAIAX (trade name)" have a sufficient effect for reducing the concentrations of carbon monoxide (CO) and hydrocarbons in the exhaust gases from the automobiles. However, the fuels have a problem in that since they contain methanol having large polarity in the component thereof, when they are used for a long period of time, a fuel supply rubber pipe, which an accessory of internal combustion engines is swollen and fuel pressure is changed and otherwise the fuel pipe is broken due to the reduction of the strength thereof.

Further, a problem is also arisen in that the rubber hoses, packings and the like used in the gas supply machines in gas stations are swollen and the life thereof is greatly reduced similarly, which is a large obstacle for the widespread use of the novel fuels.

An object of the present invention, which was made in view of the above problems, is to provide a low pollution liquid fuel, which does not cause problems such as the swell and damage of a fuel supply hose and the reduction of life thereof and is more excellent in practical utility and a method of manufacturing the fuel.

DISCLOSURE OF THE INVENTION

To achieve the above object, a low pollution liquid fuel of the present invention includes 10 - 50 vol% of at least two kinds of aliphatic monohydric alcohols having the number of hydrocarbons of 2 - 11, 40 - 60 vol% of at least one kind of saturated or unsaturated hydrocarbons and 10 - 30 vol% of at least one kind of ethers having two chain hydrocarbon groups whose number of carbon atoms is 6 or less.

According to the above feature, since methanol whose number of carbon atoms is 1 is not contained in the resulting fuel, the problem of the swell and damage of a fuel pipe and a fuel supply hose caused by the methanol having a large polarity and the reduction of life thereof can be solved, whereby a low pollution liquid fuel excellent in practical utility can be obtained.

It is preferable in the low pollution liquid fuel of the present invention that the volume percentage of the alcohols is 1/2 or more that of the saturated or unsaturated hydrocarbons.

With this arrangement, the contents of COx, HxCy, SOx, NOx, etc. contained in the exhaust gases of automobiles can be suppressed to low levels.

In the low pollution liquid fuel of the present invention, it is preferable that at least one kind of the aliphatic monohydric alcohols is nonstraight-chain alcohol.

With this arrangement, not only a higher octane value can be obtained as compared with a case in which straight-chain alcohol having the same number of carbon atoms but also the separation of alcohol components from other primary fuels can be prevented by the use of the nonstraight-chain alcohol.

In the low pollution liquid fuel of the present invention, it is preferable that the nonstraight-chain alcohol is isopropyl alcohol or isobutyl alcohol.

With this arrangement, the low pollution liquid fuel having excellent characteristics can be obtained by the use of isopropyl alcohol or isobutyl alcohol which is a nonstraight-chain alcohol having a relatively small number of carbon atoms.

In the low pollution liquid fuel of the present invention, it is preferable that the ethers are at least one kind of methyl tertiary butyl ether (MTBE), tertiary amyl methyl ether (TAME) and dibutyl ether.

With this arrangement, the octane value of the resulting fuel can be improved by a small blended amount, whereby the price of the fuel can be suppressed to a low level.

In the low pollution liquid fuel of the present invention, it is preferable that the saturated or unsaturated hydrocarbons are light duty naphtha or gasoline

containing aromatic hydrocarbon components in the content of 1% or less.

With this arrangement, since the light duty naphtha, which is relatively stable chemically and from which aromatic hydrocarbon components which are liable to be imperfectly combusted are removed, are used, not only COx and HxCy in exhaust gases can be still more reduced but also it can be prevented that benzene, toluene, xylene, etc. as the harmful aromatic hydrocarbon components are discharged together with the exhaust gases as they are.

A method of manufacturing a low pollution liquid fuel of the present invention includes the step of mixing 10 - 50 vol% of at least two kinds of aliphatic monohydric alcohols having the number of hydrocarbons of 2 - 11, 40 - 60 vol% of at least one kind of saturated or unsaturated hydrocarbons and 10 - 30 vol% of at least one kind of ethers having two chain hydrocarbon groups whose number of carbon atoms is 6 or less.

According to the feature, the respective blended primary fuels can be effectively mixed without being separated from each other.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a flowchart showing a method of manufacturing a fuel for internal combustion engine

according to an embodiment of the present invention.

Fig. 2 is a graph showing the relationship between the ratio of alcohol and petroleum components in a liquid fuel and the concentrations of the polluted gases contained in exhaust gases.

BEST MODE OF CARRYING OUT THE INVENTION

Fig. 1 is a flowchart showing a method of manufacturing a fuel for internal combustion engine according to an embodiment of the present invention. The fuel for internal combustion engine of the present invention mainly includes at least two kinds of aliphatic monohydric alcohols, straight-chain hydrocarbons, and single ether or mixed ethers. After these primary fuels are measured in predetermined volume percentages, first, the single ether or the mixed ethers whose polarity is smaller than that of the aliphatic monohydric alcohols are charged into and mixed with light duty naphtha which is straight-chain hydrocarbon having a relatively large volume and has the smallest polarity, and then the aliphatic monohydric alcohols are charged thereinto and mixed therewith, whereby the low pollution fuel of the present invention is prepared.

At the time, since at least the two kinds of the aliphatic monohydric alcohols exist, it is preferable to gradually charge them in the sequence from alcohol having a

larger number of carbon atoms which has a smaller polarity to alcohol having a smaller number of carbon atoms.

While it is preferable to sequentially blend the primary fuels whose magnitudes of polarities are near to each other as described above because the separation of the primary fuels can be prevented thereby and they can be effectively blended, the present invention is not limited thereto. Further, while the ethers and alcohols are sequentially charged into and blended with the light duty naphtha which has the low polarity, the ethers and the light duty naphtha may be sequentially charged into the alcohol having a high polarity on the contrary.

Blend examples of the fuel for internal combustion engine made by the above manufacturing method will be shown below.

<Blend example 1>

A blend example 1 contains 25 vol% of isobutyl alcohol (IBA) as one of aliphatic monohydric alcohols, 10 vol% of isopropyl alcohol (IPA) as the other thereof, 20 vol% of methyl tertiary butyl ether (MTBE) as mixed ethers and 45 vol% of light duty naphtha as the straight-chain hydrocarbons.

<Blend example 2>

A blend example 2 contains 25 vol% of butyl alcohol as one of aliphatic monohydric alcohols, 10 vol% of isopropyl

alcohol (IPA) as the other thereof, 20 vol% of methyl tertiary butyl ether (MTBE) as mixed ethers and 45 vol% of light duty naphtha as the straight-chain hydrocarbons.

<Blend example 3>

A blend example 3 contains 25 vol% of isobutyl alcohol (IBA) as one of aliphatic monohydric alcohols, 10 vol% of isopropyl alcohol (IPA) as the other thereof, 20 vol% of dibutyl ether as mixed ethers and 45 vol% of light duty naphtha as the straight-chain hydrocarbons.

<Blend example 4>

A blend example 4 contains 25 vol% of butyl alcohol as one of aliphatic monohydric alcohols, 10 vol% of isopropyl alcohol (IPA) as the other thereof, 20 vol% of dibutyl ether as mixed ethers and 45 vol% of light duty naphtha as the straight-chain hydrocarbons.

<Blend example 5>

A blend example 5 contains 25 vol% of isobutyl alcohol (IBA) as one of aliphatic monohydric alcohols, 10 vol% of isopropyl alcohol (IPA) as the other thereof, 20 vol% of tertiary amyl methyl ether (TAME) as mixed ethers and 45 vol% of light duty naphtha as the straight-chain hydrocarbons.

<Blend example 6>

A blend example 6 contains 25 vol% of butyl alcohol as one of aliphatic monohydric alcohols, 10 vol% of isopropyl

alcohol (IPA) as the other thereof, 20 vol% of tertiary amyl methyl ether (TAME) as mixed ethers and 45 vol% of light duty naphtha as the straight-chain hydrocarbons.

<Comparative example>

A comparative example contains 43 vol% of methyl alcohol as one of conventional alcohol fuels, 5 vol% of isobutyl alcohol (IBA) as the other thereof, 4 vol% of methyl tertiary butyl ether (MTBE) as mixed ethers and 48 vol% of light duty naphtha as the straight-chain hydrocarbons.

Note that the light duty naphtha referred to here is light duty naphtha which is refined so that the content of each of aromatic hydrocarbons such as B (benzene), T (toluene), X (xylene), etc. is made 1% or less in the distillation of crude oil (atmospheric distillation). The use of the light duty naphtha is preferable because it can prevent that the concentrations of CO and HC in exhaust gases are increased due to the imperfect combustion of the aromatic hydrocarbons which are relatively stable chemically and the harmful aromatic hydrocarbons such as B (benzene), T (toluene), X (xylene), etc. themselves are discharged into exhaust gases. However, the present invention is not limited thereto.

Further, straight-chain saturated or unsaturated hydrocarbons whose number of carbon atoms is 9 or less may

be used in place of all or a part of the light duty naphtha from the view point of the volatility of the naphtha and the increase of the concentrations of CO and HC in exhaust gases caused by the residuals thereof.

The aliphatic monohydric alcohols have a carbon number of at least 2 because methyl alcohol is removed therefrom. When the upper limit of the carbon number of the aliphatic monohydric alcohols is 12 or more, the initial distilling point of alcohol is increased as well as the specific weight thereof is made large and accordingly a resulting liquid fuel has a lowered igniting capability and is liable to reduce the starting property of an engine as well as the specific weight of a resulting fuel is made larger than a specific weight regulated as gasoline. Thus, the carbon number of the aliphatic monohydric alcohols must be set to 11 or less.

Further, nonstraight-chain monohydric (primary) alcohol is preferably employed as at least one kind of the aliphatic monohydric alcohols because its polarity is lower than that of straight-chain alcohol and the blending property thereof with hydrocarbon components and ethers can be improved thereby. However, the present invention is not limited thereto and these alcohols may be suitably combined from the view point of price, volatility and the like. Furthermore, it is preferable to use nonstraight-chain

aliphatic monohydric alcohols such as IPA, IBA, etc. because the octane value obtained thereby can be properly set to an internal combustion engine. However, the present invention is not limited thereto.

Further, it is preferable to use, as the above ether, ether having two chain hydrocarbon groups whose number of carbon atoms is 6 or less from the view point of the volatility and price thereof. In particular, it is preferable to use the above methyl tertiary butyl ether (MTBE), dibutyl ether, and tertiary amyl methyl ether (TAME) because the octane value of a resulting fuel can be improved by a small additive amount of them. However, the present invention is not limited to the MTBE, dibutyl ether, and TAME, and the kinds and the like of ethers to be used may be suitably selected based on the kinds and the like of alcohols which will be used.

Furthermore, the blend ratios shown in the above blend examples 1 - 6 are not limited thereto, and the respective compositions have the ranges of blend ratios in which similar excellent characteristics can be obtained. The ranges will be shown below.

{Composition system of blend example 1}

The composition system of the blend example 1 is in the range of IBA; 5 - 30 vol%, IPA; 5 - 30 vo%, MTBE; 10 - 35 vol%, and light duty naphtha or gasoline; 45 - 60 vol%.

{Composition system of blend example 2}

The composition system of the blend example 2 is in the range of butyl alcohol; 5 - 30 vol%, IPA; 5 - 30 vol%, MTBE; 10 - 35 vol%, and light duty naphtha or gasoline; 45 - 60 vol%.

{Composition system of blend example 3}

The composition system of the blend example 3 is in the range of IBA; 5 - 30 vol%, IPA; 5 - 30 vol%, butyl ether; 10 - 35 vol%, and light duty naphtha or gasoline; 45 - 60 vol%.

{Composition system of blend example 4}

The composition system of the blend example 4 is in the range of butyl alcohol; 5 - 30 vol%, IPA; 5 - 30 vol%, dibutyl ether; 10 - 35 vol%, and light duty naphtha or gasoline; 45 - 60 vol%.

{Composition system of blend example 5}

The composition system of the blend example 5 is in the range of IBA; 5 - 30 vol%, IPA; 5 - 30 vol%, TAME; 10 - 35 vol%, and light duty naphtha or gasoline; 45 - 60 vol%.

{Composition system of blend example 6}

The composition system of the blend example 6 is in the range of butyl alcohol; 5 - 30 vol%, IPA; 5 - 30 vol%, TAME; 10 - 35 vol%, and light duty naphtha or gasoline; 45 - 60 vol%.

A more preferable ratio in the above compositions is

in the range of monohydric alcohol components : ether components : petroleum components such as hydrocarbons and light duty naphtha or gasoline and the like = 3 : 2 : 5 - 3 : 1 : 6 in vol% or 2 : 2 : 6 - 3 : 1 : 6 in vol%.

When the volume percentage of the monohydric alcohol components is made less than 1/2 that of the hydrocarbons and the petroleum components such as the light duty naphtha, gasoline or the like as shown in Fig. 2, the contents of COx, HxCy, SOx, NOx, etc. in exhaust gases are increased. Thus, it is preferable to make the volume percentage of the monohydric alcohol components to 1/2 or more that of the hydrocarbons and the petroleum components such as the light duty naphtha, gasoline or the like.

Further, when the contents of MTBE, dibutyl ether and TAME are excessively increased, the octane value of the liquid fuel is made higher than that of ordinary gasoline, which is unsuitable.

Next, the liquid fuels of the blend examples 1 - 6, conventional gasoline and the conventional alternative fuel containing methyl alcohol as the blend example 7 were tested in a metal and a rubber used in existing automobile parts and in a metal and a rubber used in a gas supply machine main body for the comparison of the capabilities thereof. The result of the test is shown in Tables 1 and 2.

Table 1

Table 2

As can be seen from Tables 1 and 2, the swell of rubber and the deterioration of mechanical strength and characteristics thereof are admitted in the conventional alternative fuel containing methyl alcohol as the blend example 7 as described above. However, it can be found that the blend example 1 of the present invention is by no means inferior to the gasoline as to the swell of rubber and the deterioration of mechanical strength and characteristics thereof. Accordingly, it can be said that the low pollution liquid fuel of the present invention can be stored in the facilities of existing gas stations and used for existing gasoline-driven automobiles as it is as well as it can be arbitrarily mixed with gasoline for use. Further, characteristics similar to those of the blend example 1 can be obtained by the blend examples 2 - 6 which are not shown in Tables 1 and 2.

Next, the concentrations of the polluted gases contained in the exhaust gases of the embodiment 1, those of the comparative example and those of gasoline were compared with each other. The result of comparison is as shown below. Note that used in the comparison was an automobile of 2000 cc which satisfied the regulations for CO, HC, and NOx values stipulated by the articles 30 and 31 of Safety Standard of Japanese Automobile Inspection System.

Table 3

As can be seen from Table 3, any of the exhaust gas values (Cox, HxCy, and NOx) in the embodiment is low. In particular, it can be understood that the HxCy and COx values of the liquid fuel of the present invention (embodiment 1) are remarkably lower than those of the conventional liquid fuel (comparative example) using methanol.

Therefore, the liquid fuels of the present invention could reduce the amounts of COx and HxCy exhausted when they were combusted and further could reduce the NOx value by about 10%. In addition, since no sulfur is contained in the components of the low pollution liquid fuel of the present invention, SOx is not exhausted at all, and thus the fuel can be used as a low pollution fuel capable of reducing the effect thereof on the atmospheric pollution.

Further, the use of low pollution fuel of the present invention does not require that a conventional gasoline engine is provide with a special device, that some parts thereof is converted and that some parts thereof is replaced. Further, it is possible to mix the low pollution fuel of the present invention with conventional gasoline for use.

While the present invention has been described with reference to the above embodiment, the present invention is

by no means limited thereto and it goes without saying that various modifications and additions can be made within the range which does not depart from the gist of the invention. That is, other primary fuels and additives (including metal and the like) may be arbitrarily added within the range in which the characteristics of the fuels for internal combustion engine of the present invention are not greatly modified, and it is needless to say that these fuels are also included in the scope of the present invention.

CLAIMS

1. A low pollution liquid fuel, comprising 10 - 50 vol% of at least two kinds of aliphatic monohydric alcohols having the number of hydrocarbons of 2 - 11, 40 - 60 vol% of at least one kind of saturated or unsaturated hydrocarbons and 10 - 30 vol% of at least one kind of ethers having two chain hydrocarbon groups whose number of carbon atoms is 6 or less.

2. A low pollution liquid fuel according to claim 1, wherein the volume percentage of the alcohols is 1/2 or more that of the saturated or unsaturated hydrocarbons.

3. A low pollution liquid fuel according to claim 1 or 2, wherein at least one kind of the aliphatic monohydric alcohols is nonstraight-chain alcohol.

4. A low pollution liquid fuel according to claim 3, wherein the nonstraight-chain alcohol is isopropyl alcohol or isobutyl alcohol.

5. A low pollution liquid fuel according to any of claims 1 to 4, wherein the ethers are at least one kind of methyl tertiary butyl ether (MTBE), tertiary amyl methyl

ether (TAME) and dibutyl ether.

6. A low pollution liquid fuel according to any of claims 1 to 5, wherein the saturated or unsaturated hydrocarbons are light duty naphtha or gasoline containing aromatic hydrocarbon components in the content of 2% or less.

7. A method of manufacturing a low pollution liquid fuel, composed of primary fuels: 10 - 50 vol% of at least two kinds of aliphatic monohydric alcohols having the number of hydrocarbons of 2 - 11, 40 - 60 vol% of at least one kind of saturated or unsaturated hydrocarbons and 10 - 30 vol% of at least one kind of ethers having two chain hydrocarbon groups whose number of carbon atoms is 6 or less,

comprising the step of blending sequentially said primary fuels whose magnitude of polarities are near to each other.

ABSTRACT

According to a low pollution liquid fuel and a method of manufacturing the same of the present invention, the independent use of the liquid fuel or the mixed use thereof with gasoline enables an effect and an output similar to or greater than those of gasoline to be obtained without the need of modifying the structure or the material of existing internal combustion gasoline engines. Further, the contents of the carbon monoxide (CO) and hydrocarbons(HC) contained in exhaust gases can be remarkably reduced as compared with those emitted when the gasoline is used.

PLEASE STAMP TO ACKNOWLEDGE RECEIPT OF THE FOLLOWING:

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